In Fig. 4A, the steel strips wound on the inlet coil cars 40 and 41 are duet joined together by a welder 42 and fed out continuously.

Next, the steel strip 43 passes to the mechanical scale breaker 45 via the loop car 44. In the mechanical scale breaker 45, breakages are formed to the scale of the steel strip 43, and then the broken scales are rubbed off with the mechanical brush 46.

After these processings, the steel strip 43 passes through the descaling apparatus 47 in Fig. 4B, which has the structural details of Fig. 2, 3A and 3B. The Descaling apparatus 47 has a hydrochloride electrolysis part 48 using hydrochloric acid 49 as an electrolyte. In hydrochloride electrolysis part 48, the cathodes 24 are arranged in a first upstream half, and the anodes 23 are arranged in the latter downstream half.

The chemical reactions in the hydrochloride electrolysis cell part 48 are the following;

(on the cathodes)

$$Fe_2O_3 + 6H^+ + 2E \rightarrow 2Fe_2^+ + 3H_2O \quad (2)$$

$$Fe_3O_4 + 8H^+ + 2E \rightarrow 2Fe_2^+ + 4H_2O \quad (3)$$

(on the anodes)

$$Fe \rightarrow Fe_2^+ + 2E \quad (4)$$

The hydrochloride density is 180 G /L , which is the same as the conventional electrolysis, and the temperature is 85 ℃.

According to the chemical reactions (2) and (3) on the cathode 24, the scale dissolves and is removed from the steel strip 1. According to the chemical reaction (4) on the anode 23, the foundation (normal steel) dissolves, and as a result the scale exfoliates from steel strip 43. While the electric current density has a preferred value according to by a steel kind such as a normal steel and a stainless steel, or a size of the steel, it is preferred to control the electric current density in the range of the 1 - 20A/cm^2 generally.

The steel strip 43 passes through the mill stand 51 via the centering apparatus 50 in Fig. 4C. The steel strip 43 is cold-rolled by the HC mill of No. 1 - 4, and it is manufactured to thin plate. In Fig. 4D, the thin plate steel strip 43 passes through the rotary type scrap chopper 52 and the oiler 53 and is wound on the outlet coil car 54.

According to the example 2, jetting the hydrochloric acid 49 in the air reduces the quantity of the hydrochloric acid 49, to miniaturize the hydrochloride electrolytic part 48 and thereby to miniaturize the manufacturing apparatus similar to the example 1.

According to the example 1 and 2, by adjusting the jet pressure of the electrolyte to both sides of the steel strip 1, 43, the waving and the flexure of the steel strip 1, 43 are prevented, and so it is possible to arrange the anodes 23 and the cathodes 24 close to the steel strip 1, 43. Therefore, as

the voltage drop between the electrodes and the steel strip 43 becomes lower, the electric power for the descaling decreases similar for bath to the examples 1 and 2.

According to the example 2, compared with the conventional electrolysis, since the short-circuit current between the anodes 23 and the cathodes 24 decreases very much, the electric power efficiency improves similar to the example 1.

According to the example 2, because the electrode is integrated with the nozzle that jets the hydrochloric acid 49, supply of the large electric current to the steel strip 43 through the jetted electrolyte, similar to the example 1.

Therefore, as the electric current density of the steel strip 43 is large , the descaling rapidly similar to the example 1. Providing many electrodes improves the descaling speed more because the electric current to the steel strip 43 increases similar to the example 1.

Another example of the electrodes 23, 24 is explained with respect to Fig. 5. A conductor 29 is placed at a electrolytic way 34, and an electric insulating material 30 covers an end of the electrodes 23, 24. As Fig. 5B show, the electric insulating material 30 surrounds the conductor 29, which surrounds the electrolytic way 34. The electric insulating material 30 prevent a discharge between the electrodes and the steel strip when the electrodes 23, 24 contact the steel strip and we can protect the steel strip